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Original Article

Comparative Analysis of Hyaluronic Acid and Corticosteroid Injections in the Treatment of Temporomandibular Joint Osteoarthritis.

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Abstract

Background: Temporomandibular joint (TMJ) osteoarthritis is a common disorder that results in pain, dysfunction, and limited mouth opening. Intra-articular injections of hyaluronic acid (HA) and corticosteroids are frequently utilized in the management of TMJ osteoarthritis, yet their comparative efficacy remains unclear. **Objective:** The aims to compare the clinical outcomes of intra-articular hyaluronic acid versus corticosteroid injections in the treatment of temporomandibular joint osteoarthritis. **Methodology:** This randomized controlled trial was conducted in the Department of Department of Orthopedics, Monno Medical college and Hospital, Manikganj, Bangladesh and Department of Otolaryngology, Monno Medical College and Hospital, Manikganj, Bangladesh which was included 42 participants with TMJ osteoarthritis. Participants were randomly assigned to receive either intra-articular hyaluronic acid (n=21) or corticosteroid (n=21) injections. Clinical outcomes were assessed at baseline, and at 4-, 8-, and 12-weeks post-treatment. Primary outcomes included changes in visual analog scale (VAS) pain scores and mouth opening measurements. Secondary outcomes included adverse events. **Results:** Both treatment groups demonstrated significant improvements in VAS pain scores and mouth opening over the 12-week study period. However, at Week 12, the hyaluronic acid group showed a significantly greater reduction in pain (p=0.042) and improvement in mouth opening (p=0.022) compared to the corticosteroid group. No significant differences were observed between the groups regarding adverse events. **Conclusion:** Intra-articular hyaluronic acid injections provide superior long-term pain reduction and improvement in mouth opening compared to corticosteroid injections in the treatment of TMJ osteoarthritis. Both treatments were well-tolerated with minimal adverse effects.

Keywords: Temporomandibular joint, osteoarthritis, hyaluronic acid, corticosteroids, intra-articular injections, pain management, mouth opening, clinical outcomes

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Introduction

Temporomandibular joint (TMJ) disorders encompass a range of conditions affecting the joint and its surrounding tissues. According to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), there are twelve types of TMJ disorders, including myalgia, arthralgia, disc displacement, and degenerative joint diseases like osteoarthritis (OA)[1]. Among these, TMJ osteoarthritis (TMJ OA) is a prevalent condition, particularly involving degenerative changes in the articular surfaces of the condyle and fossa, often due to mechanical and biological factors such as bruxism, trauma, and genetic

predisposition[2]. TMJ OA, like other osteoarthritic conditions, leads to joint pain, dysfunction, and sometimes the degeneration of joint surfaces. The disease is typically characterized by symptoms such as pain, limited mouth opening, joint noise (crepitation), and radiographic evidence of surface wear and flattening of the condyle[3]. TMJ OA is a prevalent condition, with its occurrence reported to range from 8% to 60%[4]. In the context of treatment, the primary goals are to reduce pain, restore normal mandibular movements, and improve the patient's quality of life[5]. In the treatment of TMJ OA, non-invasive methods such as occlusal splints, physical therapy, and pharmacotherapy are commonly employed. However, when these conservative treatments fail, more invasive options such as intra-articular injections of steroids and hyaluronic acid (HA), are considered[6]. Corticosteroids are a type of steroid commonly used to reduce inflammation and pain in joint disorders, such as temporomandibular joint osteoarthritis, often administered through intra-articular injections for localized relief where hyaluronic acid, a type of glycosaminoglycan, is commonly chosen for intra-articular injections, are known for their role in joint lubrication and protection of cartilage, which is often compromised in osteoarthritic joints[7-9]. The concept of visco-supplementation, which involves restoring the concentration and molecular weight of HA in the joint, has shown therapeutic promise in various osteoarthritic conditions, including TMJ OA[10]. The efficacy of intra-articular HA injections in TMJ OA has been well-documented, with studies suggesting that these injections can improve symptoms by enhancing lubrication and promoting the repair of damaged cartilage[11].

However, steroid injections, while commonly used for their anti-inflammatory effects, may present potential side effects such as joint tissue damage, they remain a frequently used option due to their rapid pain relief and anti-inflammatory properties[12,13]. Studies indicate that both intra-articular injections of HA and steroids provide significant benefits for TMJ OA, with treatment choice influenced by disease severity and patient response[13]. The comparison between HA and steroids in TMJ OA is noteworthy, as the two treatments function differently. Steroids may have potential long-term effects on joint tissues, making HA a preferred option due to its safety profile and lower risk of side effects[12]. The therapeutic benefits of HA injections have been explored in other osteoarthritic joints, and preliminary findings suggest that similar benefits may be achieved in the TMJ[10]. The aim of the study was to compare the clinical outcomes of intra-articular hyaluronic acid versus corticosteroid injections in the treatment of temporomandibular joint osteoarthritis.

Methodology

Study Settings and Population: This prospective observational study was conducted in the Department of Orthopedics, Monno Medical college and Hospital, Manikganj, Bangladesh and Department of Otolaryngology, Monno Medical College and Hospital, Manikganj, Bangladesh from March 2022 to December, 2022. The research comprehensively examined the clinical outcomes associated with intra-articular injections of hyaluronic acid and corticosteroids for managing temporomandibular joint (TMJ) osteoarthritis. The study employed a purposive sampling method, enrolling all patients from the outpatient department to create a well-defined and representative study cohort. Participant selection was guided by stringent inclusion criteria to ensure the reliability and clinical significance of the findings. Patients were stratified into two groups based on the treatment protocol.

Inclusion Criteria: Patients aged 30 years or older, clinically diagnosed with TMJ osteoarthritis based on presenting symptoms such as pain, crepitus, and restricted mouth opening, corroborated by radiographic findings, experienced persistent symptoms for at least three months and had no prior history of TMJ injections or surgical interventions were included.

Exclusion criteria: Patients with systemic inflammatory conditions, such as rheumatoid arthritis, a history of TMJ trauma or fracture, known allergies to study medications, or those who were pregnant or lactating, were excluded from the study.

Allocation and Randomization: Injections were administered under strict aseptic conditions. The Hyaluronic Acid Group received 2 mL of high-molecular-weight hyaluronic acid, while the Steroid Group was treated with 1 mL of triamcinolone acetonide (40 mg/mL). The injections were delivered into the superior joint space of the TMJ using established anatomical landmarks to ensure precision.

Follow Up and Outcome Measures: Data were gathered using a structured and validated questionnaire. Baseline demographics and clinical parameters, including age, gender, body mass index (BMI), and duration of symptoms, were recorded. Pain levels were assessed with

the Visual Analog Scale (VAS),[14] and the range of mouth opening was measured using a digital caliper. Follow-up assessments occurred at 4, 8, and 12 weeks to evaluate pain reduction, improvement in mouth opening, and potential adverse events. Ethical approval for the study was obtained from the institutional ethics committee, and informed consent was secured from all participants.

Statistical Analysis: Demographic data and baseline characteristics were collected and compared between groups using independent t-tests and chi-square tests. Continuous variables were presented as mean ± standard deviation (SD). Repeated measures ANOVA was used to compare temporal changes in VAS scores and mouth opening within and between groups. A p-value of <0.05 was considered statistically significant. All analyses were performed using SPSS software (Version 26.0).

Ethical Clearance: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and analyzed using the coding system.

Results

A total of 42 patients participated in this study, with an equal distribution between the Hyaluronic Acid group (n=21) and the Steroid group (n=21). The mean age was comparable, with 54.31±8.25 years in the Hyaluronic Acid group and 55.14±7.93 years in the Steroid group. Most patients were aged 46–55 years. Gender distribution was nearly equal, with no statistically significant difference (p=0.782). The mean BMI was slightly higher in the Steroid group (25.14±3.12 kg/m²) than in the Hyaluronic Acid group (24.76±2.87 kg/m²) (p=0.647). The mean duration of symptoms was 15.25±4.82 months in the Hyaluronic Acid group and 16.18±5. 29 months in the Steroid group (p=0.584). Baseline pain scores were 7.44±1.18 in the Hyaluronic Acid group and 7.64±1.32 in the Steroid group (p=0.683). Baseline mouth opening was 29.69±5.43 mm in the Hyaluronic Acid group and 30.26±4.91 mm in the Steroid group (p=0.746). No significant differences were observed between the groups in demographic characteristics (Table 1).

Table 1: Demographic Characteristics of Study Participants (n=42)

Variables	Hyaluronic Acid Group (n=21)	Steroid Group (n=21)	P value
Age Group			
• ≤45 Years	4(19.1%)	3(14.3%)	
• 46 to 55 Years	8(38.1%)	9(42.9%)	
• 56 to 65 Years	6(28.6%)	5(23.8%)	0.721**
• More Than 65 Years	3(14.3%)	4(19.1%)	
Mean±SD	54.3±8.25	55.1±7.93	
Gender			
• Male	10(47.6%)	9(42.9%)	0.782*
• Female	11(52.4%)	12(57.1%)	
BMI (kg/m²) (Mean±SD)	24.76±2.87	25.14±3.12	0.647*
Duration of symptoms (months)	15.25±4.82	16.18±5.29	0.584*
Baseline VAS pain score	7.44± 1.18	7.64±1.32	0.683*
Baseline mouth opening (mm)	29.69±5.43	30.26±4.91	0.746*

*Student t test was performed to see the label of significance; **Chi-square test was performed to see the label of significance

VAS pain scores were assessed at multiple time points. At baseline, the Hyaluronic Acid group had a score of 7.42±1.13 and the Steroid group 7.67±1.38 (p=0.682). At Week 4, pain scores decreased to 5.28±1.27 and 5.55±1.47, respectively (p=0.534). At Week 8, the Hyaluronic Acid group had a lower mean score (3.85±1.14) than the Steroid group (4.41±1.35) (p=0.115) (Table 2).

Table 2: Temporal changes in VAS pain score (Mean±SD)

Time Point	Hyaluronic Acid Group	Steroid Group	P value
Baseline	7.42±1.13	7.67±1.38	0.682
Week 4	5.28±1.27	5.55±1.47	0.534
Week 8	3.85±1.14	4.41±1.35	0.115
Week 12	3.16±0.93	3.83±1.26	0.042

By Week 12, the Hyaluronic Acid group showed a significantly lower score (3.16±0.93) than the Steroid group (3.83±1.26) (p=0.042). Mouth opening changes were also analyzed. At baseline, values were 29.62±5.43 mm in the Hyaluronic Acid group and 30.22±4.97 mm in the Steroid group (p=0.742). By Week 4, both groups showed improvement, reaching 32.14±4.88 mm and 31.74±5.15 mm, respectively (p=0.686). At Week 8, further increases were observed, with the Hyaluronic Acid group at 35.45±4.28 mm and the Steroid group at 33.62±4.75 mm (p=0.098). By Week 12, a significantly greater increase was seen in the Hyaluronic Acid group (37.16±3.97 mm) compared to the Steroid group (34.42±4.18 mm) (p=0.022) (Table 3).

Table 3: Temporal Changes in Mouth Opening (mm) (Mean±SD)

Time Point	Hyaluronic Acid Group	Steroid Group	P value
Baseline	29.62±5.43	30.22±4.97	0.742
Week 4	32.14±4.88	31.74±5.15	0.686
Week 8	35.45±4.28	33.62±4.75	0.098
Week 12	37.16±3.97	34.42±4.18	0.022

*Student t test was performed to see the label of significance

Pain reduction was greater in the Hyaluronic Acid group (4.28±1.24) than in the Steroid group (3.81±1.47) (p=0.194). Mouth opening improvement was also greater (7.47±2.18 mm vs. 4.16±1.82 mm) with a near-significant difference (p=0.071). Localized swelling was seen in 4.76% and 9.52% of patients, respectively (p=0.558). Pain at the injection site occurred in 9.52% and 14.29%, respectively (p=0.639). One infection was reported in the Steroid group (p=0.315) (Table 4).

Table 4: Comparison of Clinical Outcomes between Groups after 12 weeks (N=42)

Outcomes	Hyaluronic Acid Group	Steroid Group	P value
VAS pain score reduction(Mean±SD)	4.28±1.24	3.81±1.47	0.194*
Improvement in mouth opening (mm) (Mean±SD)	7.47±2.18	4.16±1.82	0.071*
Adverse events			
Localized swelling	1(4.8%)	2(9.5%)	0.558**
Pain at injection site	2(9.5%)	3(14.3%)	0.639**
Infection	0(0.0%)	1(4.7%)	0.315**

*Student t test was performed to see the label of significance;
**Chi-square test was performed to see the label of significance

Discussion

Temporomandibular joint osteoarthritis (TMJ OA) is a common condition that leads to pain, limited mouth opening, and functional impairment[15]. Intra-articular injections of hyaluronic acid (HA) and corticosteroids (CS) are frequently used treatments for symptom management[16]. HA is known to provide lubrication and reduce inflammation in the joint, while CS offers potent anti-inflammatory effects[16]. Both treatments have demonstrated efficacy in improving pain and function, yet their comparative long-term benefits remain unclear. In our study, the comparative analysis of hyaluronic acid (HA) and corticosteroid (CS) injections for the treatment of temporomandibular joint osteoarthritis (TMJ OA) demonstrated differential effects on pain reduction and functional improvement over a 12-week period. The findings align with prior research highlighting the efficacy of intra-articular injections in managing TMJ OA symptoms, though the magnitude of benefit varied between treatment modalities[15]. At baseline, both groups exhibited similar demographic characteristics, such as age, gender, BMI, and symptom duration.

These findings suggest that the two groups were comparable at the outset, reducing the potential for confounding variables in the subsequent analysis. With respect to pain relief, although both groups showed a progressive decline in visual analog scale (VAS) scores, the HA group exhibited a significantly lower pain score at 12 weeks compared to the CS group (3.16 ± 0.93 vs. 3.83 ± 1.26, p = 0.042). This finding aligns with previous studies indicating that HA has a prolonged analgesic effect by restoring joint lubrication and modulating inflammatory cytokines[17]. Conversely, corticosteroids provide rapid pain relief by suppressing inflammation but may have a shorter duration of efficacy due to their catabolic effects on cartilage[18]. The present study observed a steady increase in mouth opening in both treatment groups. At baseline, there was no significant difference in interincisal opening between groups. By Week 4, the improvements remained comparable. However, at Week 8, the HA group showed a greater improvement trend (HA: 35.45±4.28 mm, Steroid: 33.62±4.75 mm, p=0.098), which became statistically significant by Week 12 (HA: 37.16±3.97 mm, Steroid: 34.42±4.18 mm, p=0.022). This suggests that HA may provide better long-term functional recovery. This is consistent with the biomechanical role of HA in enhancing synovial fluid viscosity and promoting chondroprotection[19,20]. Notably, previous randomized

controlled trials have reported similar trends, suggesting that HA may facilitate long-term joint mobility improvements compared to steroids21. Although both treatments were well-tolerated, mild adverse events were observed. Pain at the injection site and localized swelling were slightly more common in the CS group, possibly due to its inflammatory response upon intra-articular administration. Additionally, one case of infection occurred in the CS group, which aligns with prior reports of an increased risk of local immunosuppression following steroid injections[22].

There are limitations of this present study. Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. The observational design restricts causal conclusions, and a randomized controlled trial would provide stronger evidence. The 12-week follow-up period may not reflect long-term effects. Additionally, only mouth opening was assessed as a functional outcome, without considering other factors such as chewing ability or quality of life.

Conclusion

TMJ osteoarthritis is a debilitating condition that can significantly impact a patient's quality of life. The present study demonstrates that both hyaluronic acid (HA) and corticosteroid injections are effective in managing pain and improving mouth opening in patients with TMJ osteoarthritis. However, our results suggest that HA injections may offer superior outcomes, with a more significant reduction in pain and a greater improvement in mouth opening after 12 weeks. Both treatments were well-tolerated, with minimal adverse events, confirming their safety profiles. These findings provide valuable insights into the potential of HA as a treatment modality for TMJ osteoarthritis.

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References

1. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. Journal of oral & facial pain and headache. 2014;28(1):6.

2. Kalladka M, Quek S, Heir G, Eliav E, Mupparapu M, Viswanath A. Temporomandibular joint osteoarthritis: diagnosis and long-term conservative management: a topic review. The Journal of Indian Prosthodontic Society. 2014 ;14:6-15.

3. Liu Y, Wu J, Fei W, Cen X, Xiong Y, Wang S, Tang Y, Liang X. Is there a difference in intra-articular injections of corticosteroids, hyaluronate, or placebo for temporomandibular osteoarthritis?. Journal of Oral and Maxillofacial Surgery. 2018 1;76(3):504-14.

4. Dumbuya A, Gomes AF, Marchini L, Zeng E, Comnick CL, Melo SL. Bone changes in the temporomandibular joints of older adults: a cone-beam computed tomography study. Special Care in Dentistry. 2020 ;40(1):84-9.

5. Al-Moraissi EA, Wolford LM, Ellis III E, Neff A. The hierarchy of different treatments for arthrogenous temporomandibular disorders: A network meta-analysis of randomized clinical trials. Journal of Cranio-Maxillofacial Surgery. 2020 1;48(1):9-23.

6. Kilic SC, Gungormus M. A comparison of effects of platelet-rich plasma, hyaluronic acid, and corticosteroid injections following arthrocentesis on pain during joint palpation after treatment of temporomandibular joint osteoarthritis. J. Dent. Fac. Atatürk Uni. 2016;26:407-12.

7. Kroese JM, Kopp S, Lobbezoo F, Alstergren P. Corticosteroid injections in the temporomandibular joint temporarily alleviate pain and improve function in rheumatoid arthritis. Clinical rheumatology. 2021 ;40:4853-60.

8. Derwich M, Mitus-Kenig M, Pawlowska E. Mechanisms of action and efficacy of hyaluronic acid, corticosteroids and platelet-rich plasma in the treatment of temporomandibular joint osteoarthritis—a systematic review. International journal of molecular sciences. 2021 Jul 9;22(14):7405.

9. Fragassi A. Rational development of intra-articular drug delivery systems for the treatment of osteoarthritis. Genova (Italy): Università degli Studi di Genova; 2024

10. Goiato MC, Da Silva EV, de Medeiros RA, Túrcio KH, Dos Santos DM. Are intra-articular injections of hyaluronic acid effective for the treatment of temporomandibular disorders? A systematic review. International journal of oral and maxillofacial surgery. 2016 Dec 1;45(12):1531-7.

11. Hepguler S, Akkoc YS, Pehlivan M, Ozturk C, Celebi G, Saracoglu A, Ozpinar B. The efficacy of intra-articular sodium hyaluronate in patients with reducing displaced disc of the temporomandibular joint. Journal of oral rehabilitation. 2002 ;29(1):80-6.

12. Creech-Organ JA, Szybist SE, Yurgil JL. Joint and soft tissue injections. American Family Physician. 2023 Aug;108(2):151-8.

13. Mao T, Wang W. Comparison of outcomes with intra-articular hyaluronic acid vs corticosteroids after TMJ arthrocentesis: a systematic review and meta-analysis. Quintessence International. 2024 Sep 1;55(8).

14. Bjørnland T, Gjaerum AA, Møystad A. Osteoarthritis of the temporomandibular joint: an evaluation of the effects and complications of corticosteroid injection compared with injection with sodium hyaluronate. Journal of oral rehabilitation. 2007 Aug;34(8):583-9.

15. Guarda-Nardini L, Piccotti F, Mogno G, Favero L, Manfredini D. Age-related differences in temporomandibular disorder diagnoses. CRANIO®. 2012 1;30(2):103-9.

16. He WW, Kuang MJ, Zhao J, Sun L, Lu B, Wang Y, Ma JX, Ma XL. Efficacy and safety of intraarticular hyaluronic acid and corticosteroid for knee osteoarthritis: a meta-analysis. International Journal of Surgery. 2017 Mar 1;39:95-103.

17. Ferreira ND, Sanz CK, Raybolt A, Pereira CM, DosSantos MF. Action of hyaluronic acid as a damage-associated molecular pattern molecule and its function on the treatment of temporomandibular disorders. Frontiers in Pain Research. 2022 18;3:852249.

18. Hauser RA. The deterioration of articular cartilage in osteoarthritis by corticosteroid injections. Journal of Prolotherapy. 2009;1(2):107-23.

19. Milas M, Rinaudo M, Roure I, Al-Assaf S, Phillips GO, Williams PA. Comparative rheological behavior of hyaluronan from bacterial and animal sources with cross-linked hyaluronan (hylan) in aqueous solution. Biopolymers: Original Research on Biomolecules. 2001 5;59(4):191-204.

20. Vincent HK, Percival SS, Conrad BP, Seay AN, Montero C, Vincent KR. Hyaluronic acid (HA) viscosupplementation on synovial fluid inflammation in knee osteoarthritis: a pilot study. The open orthopaedics journal. 2013 20;7:378.

21. Attia AA, Awad SS. Hyaluronic acid and platelet-rich plasma mixture versus hyaluronic acid and corticosteroid in the treatment of temporomandibular joint internal derangement: a comparative randomized study. Journal of Maxillofacial and Oral Surgery. 2024 ;23(2):271-7.

22. Liu Y, Wu JS, Tang YL, Tang YJ, Fei W, Liang XH. Multiple treatment meta-analysis of intra-articular injection for temporomandibular osteoarthritis. Journal of Oral and Maxillofacial Surgery. 2020 1;78(3):373-e1.